

Translation of Japanese Patent Application No. 7-205886

[Type of Document(s)]	Application for patent
[Reference Number]	2960048
[Filing Date]	August 11, 1995
[Addressee]	Director-General of the Patent Office, Esq.
[International Patent Classification]	H04N 9/64
[Title of Invention]	IMAGE REPRODUCING METHOD AND APPARATUS
[Number of Claim(s)]	6
[Inventor(s)]	
[Address/Domicile]	c/o Canon Kabushiki Kaisha 30-2, Shimomaruko 3-chome, Ohta-ku, Tokyo, Japan
[Name]	Yoshinobu SHIRAIWA
[Inventor(s)]	
[Address/Domicile]	c/o Canon Kabushiki Kaisha 30-2, Shimomaruko 3-chome, Ohta-ku, Tokyo, Japan
[Name]	Eiichiro IKEDA
[Inventor(s)]	
[Address/Domicile]	c/o Canon Kabushiki Kaisha 30-2, Shimomaruko 3-chome, Ohta-ku, Tokyo, Japan
[Name]	Kenji TAKAHASHI
[Applicant for Patent]	
[Identification Number]	000001007
[Name]	Canon Kabushiki Kaisha
[Representative]	Hajime MITARAI
[Agent]	
[Identification Number]	100090273
[Patent Attorney]	
[Name]	Takayoshi KOKUBUN
[Telephone]	03-3590-8901
[Detail of Fee(s)]	

[Register Number of  
Prepayment] 035493

[Amount of Payment] 21000

[List of Attached Documents]

[Classification] Specification 1

[Classification] Drawing(s) 1

[Classification] Abstract 1

[Number of General Power of  
Attorney] 9117732

[Type of the Document] Specification

[Title of the Invention] IMAGE REPRODUCING METHOD AND  
APPARATUS

[What Is Claimed Is:]

- 5           [Claim 1] An image reproducing method  
characterized by performing image reproduction  
processing in which an image sensing signal obtained by  
an image sensing device is converted into a  
visualizable image signal, and comprising  
10           determining at least one of a plurality of image  
reproduction parameters used at the time of said image  
reproduction, on the basis of at least another image  
reproduction parameter.

- [Claim 2] The image reproducing method according  
15   to claim 1, characterized in that  
          said image reproduction parameters are a white  
balance coefficient and a complementary color-pure  
color conversion function, and  
          said complementary color-pure color conversion  
20   function is determined on the basis of said white  
balance coefficient.

- [Claim 3] An image reproducing apparatus  
characterized in that said apparatus performs image  
reproduction processing in which an image sensing  
25   signal obtained by an image sensing device is converted  
into a visualizable image signal, and comprises

means for determining at least one of a plurality of image reproduction parameters used at the time of said image reproduction, on the basis of at least one other image reproduction parameter.

5        [Claim 4] The image reproducing apparatus according to claim 3, characterized in that

      said image reproduction parameters are a white balance coefficient and a complementary color-pure color conversion function, and

10        said image reproduction parameter determining means determines said complementary color-pure color conversion function on the basis of said white balance coefficient.

      [Claim 5] The image reproducing apparatus  
15 according to claim 4, characterized in that said image reproduction parameter determining means comprises

      storage means for storing a reference complementary color-pure color conversion function, and  
      altering means for altering the reference

20 complementary color-pure color conversion function in accordance with a predetermined alteration rule on the basis of the white balance coefficient, thereby determining a complementary color-pure color conversion function in accordance with the white balance  
25 coefficient.

      [Claim 6] The image reproducing apparatus

according to claim 4, characterized in that said image reproduction means comprises

storage means for storing a plurality of the complementary color-pure color conversion functions

5 previously determined in accordance with a plurality of light source conditions, and

selecting means for selecting one of the plurality of complementary color-pure color conversion functions stored in said storage means in accordance with the

10 white balance coefficient.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to an image

15 reproducing method and apparatus and, more particularly, is preferably applied to an image reproducing method for performing image reproduction processing to convert an image sensing signal obtained from an image sensing device, such as an image sensing tube or a CCD, into a  
20 visualizable image signal (e.g., an NTSC-RGB signal) and a color image reproducing apparatus utilizing the method.

[0002]

[Prior Art]

25 In a conventional television camera using an image sensing device such as an image sensing tube or a CCD,

predetermined processing is performed using various image reproduction parameters upon image reproduction processing for converting an image sensing signal obtained by the image sensing device into a  
5 visualizable image signal. In order to constantly obtain images which apparently give the same impression or to obtain as faithful reproduced images as possible regardless of deterioration with time of the image sensing device or a color filter and changes in an  
10 illuminating light source, image reproduction parameters are generally determined from the image sensing signal itself. For example, such processing is performed for correcting a color temperature.

[0003]

15 In a television camera of this type, the correction of the color temperature is to adjust a so-called white balance so that an object (or an object to be photographed) which is supposed to look white accurately looks white. Generally, this color  
20 temperature correction is performed by determining a white portion from the data obtained by the image sensing operation. That is, image data which is supposed to look white is extracted from image data, and a white balance coefficient as one image  
25 reproduction parameter is determined on the basis of the extracted data.

[0004]

Usually, in the white balance adjustment, a plurality of color component signals constituting an output image signal from an image sensing device are  
5 respectively multiplied with gains by using the white balance coefficient to correct the color temperature. Consequently, the output levels of the color components constituting the image signal of the object which is supposed to look white are so adjusted as to be equal  
10 to each other.

[0005]

An example of a mechanism for actually performing the above-described color temperature correction which has been conventionally commonly employed is shown in  
15 Fig. 4. Referring to Fig. 4, complementary color data (consisting of color component signals of magenta Ma, green Gr, yellow Ye, and cyan Cy) obtained by an image sensing unit 1 is supplied to a complementary color-pure color converting unit 11. The complementary color  
20 data is converted into pure color data (consisting of color component signals of red R, green G, and blue B) in the complementary color-pure color converting unit 11. The white balance of the pure color data obtained by the complementary color-pure color converting unit  
25 11 is adjusted by a white balance (WB) adjusting unit 12 in the subsequent stage, and the gamma of the data

is corrected by a gamma correcting unit 4.

[0006]

In the configuration shown in Fig. 4, the WB  
adjusting unit 12 is arranged subsequently to the  
5 complementary color-pure color converting unit 11, and  
the color temperature correction is done by performing  
the white balance adjustment for the pure color data  
(R,G,B) after complementary colors are converted into  
pure colors. This configuration is advantageous in  
10 that the color temperature correction can be relatively  
easily performed because the gain of the pure color  
data (R,G,B) can be directly adjusted.

[0007]

Alternatively, the white balance adjustment has  
15 been recently frequently performed by an image  
reproducing apparatus of the configuration shown in Fig.  
5. In the configuration shown in Fig. 5, a WB  
adjusting unit 2 adjusts the white balance of  
complementary color data (Ma,Gr,Ye,Cy) obtained by an  
20 image sensing unit 1. Thereafter, a complementary  
color-pure color converting unit 3 performs  
complementary color-pure color conversion to obtain  
pure color data (R,G,B). This configuration has the  
advantage that a luminance signal with a higher  
25 resolution than that obtained in the configuration  
shown in Fig. 4 can be easily obtained.



[0008]

[Problems That the Invention Is to Solve]

The hue of an image is generally adjusted by adjusting the white balance as follows. An object  
5 which is supposed to look white under a certain photographing light source is photographed. The amplification factor of each of a plurality of color component signals constituting an image signal obtained from the image sensing device is so adjusted that the  
10 white object accurately looks white when the image signal is reproduced. That is, it can be considered that the white balance adjustment is performed to compensate for changes in the light source during photography.

15 [0009]

Commonly, the white balance adjustment described above is a principal means for compensating for changes in the light source during photography. A white balance coefficient used in this white balance  
20 adjustment is obtained on the basis of information of the light source during photography.

[0010]

Of a plurality of different image reproduction parameters used in image reproduction, some parameters  
25 are preferably obtained on the basis of information of the light source during photography, like the image

reproduction parameter (white balance coefficient) used in the white balance adjustment. An example is a complementary color-pure color conversion matrix used to convert an image sensing signal obtained by using a complementary color filter into a pure color signal.

5 [0011]

The complementary color-pure color conversion matrix is determined by the spectral transmittance characteristic of a complementary color filter.

10 Usually, the spectral transmittance characteristic of a complementary color filter differs from an ideal characteristic. The influence of this difference from the ideal characteristic changes in accordance with the characteristics of the light source during photography.

15 That is, a complementary color-pure color conversion matrix optimally selected under a certain photographing light source gives an optimum complementary color-pure color conversion result under this light source. However, this matrix generally does not give suitable

20 conversion results to all light sources.

[0012]

When a photographing light source changes, therefore, it is desirable to change the complementary color-pure color conversion matrix in accordance with

25 the light source. Also, the above two image reproduction parameters, i.e., the white balance

coefficient and the complementary color-pure color conversion matrix, are related to each other under a certain photographing light source. Accordingly, it is undesirable to individually determine these parameters.

5 [0013]

However, in a conventional image reproducing apparatus, the complementary color-pure color conversion as described above is performed by using a semi-fixed complementary color-pure color conversion  
10 matrix which is optimally set under a certain photographing light source. If the photographing light source changes, therefore, the influence of the difference of the spectral transmittance characteristic of a complementary color filter from the ideal  
15 characteristic increases. Also, a contradiction sometimes occurs between the white balance coefficient and the complementary color-pure color conversion matrix having the correlation. Consequently, no complementary color-pure color conversion can be  
20 properly performed, and this makes faithful reproduction of an image difficult.

[0014]

The present invention has been made to solve the above problems, and has as its object to constantly  
25 perform appropriate complementary color-pure color conversion, thereby enabling faithful and accurate

reproduction of images even if the photographing light source changes.

[0015]

[Means of Solving the Problems]

5       The present invention provides an image reproducing method for performing image reproduction processing in which an image sensing signal obtained by an image sensing device is converted into a visualizable image signal, comprising determining at  
10   least one of a plurality of image reproduction parameters used at the time of the image reproduction, on the basis of at least one other image reproduction parameter.

[0016]

15       The present invention is further characterized in that the image reproduction parameters are a white balance coefficient and a complementary color-pure color conversion function and the complementary color-pure color conversion function is determined on the  
20   basis of the white balance coefficient.

[0017]

      The present invention also provides an image reproducing apparatus for performing image reproduction processing in which an image sensing signal obtained by  
25   an image sensing device is converted into a visualizable image signal, comprising means for

determining at least one of a plurality of image reproduction parameters used at the time of the image reproduction, on the basis of at least one other image reproduction parameter.

5 [0018]

The present invention is further characterized in that the image reproduction parameters are a white balance coefficient and a complementary color-pure color conversion function and the image reproduction  
10 parameter determining means determines the complementary color-pure color conversion function on the basis of the white balance coefficient.

[0019]

The present invention is further characterized in  
15 that the image reproduction parameter determining means comprises storage means for storing a reference complementary color-pure color conversion function, and altering means for altering the reference complementary color-pure color conversion function in accordance with  
20 a predetermined alteration rule on the basis of the white balance coefficient to determine a complementary color-pure color conversion function in accordance with the white balance coefficient.

[0020]

25 The present invention is further characterized in that the image reproduction parameter determining means

comprises storage means for storing a plurality of complementary color-pure color conversion functions previously determined in accordance with a plurality of light source conditions, and selecting means for  
5 selecting one of the plurality of complementary color-pure color conversion functions stored in the storage means in accordance with the white balance coefficient.  
[0021]

[Operation of the Invention]

10 The present invention comprises the above technical means and enables an image sensing signal to be converted into an image signal by using an image reproduction parameter group consisting of more accurate image reproduction parameters without any  
15 contradiction between correlated image reproduction parameters or inefficient determination of image reproduction parameters, which occurred in the prior art wherein the respective image reproduction parameters were individually determined.

20 [0022]

For example, when a white balance coefficient and a complementary color-pure color conversion function are used as image reproduction parameters, the complementary color-pure color conversion function is  
25 determined on the basis of the white balance coefficient determined in accordance with the condition

of a photographing light source. For this reason,  
there exists no contradiction between the complementary  
color-pure color conversion function and the white  
balance coefficient, and a more accurate complementary  
5 color-pure color conversion function can be obtained in  
accordance with the condition of the photographing  
light source.

[0023]

[Embodiments]

10 As described above with respect to the  
conventional example, various image reproduction  
parameters used to obtain an optimum reproduced image  
in image reproduction processing may be associated with  
each other via a certain photographing light source.  
15 In this case, the association between these image  
reproduction parameters is fully utilized, i.e., one  
parameter is obtained by using information that another  
parameter has. Consequently, the image reproduction  
processing can be efficiently and accurately performed.  
20 The present invention has been made to realize this  
processing.

[0024]

An image reproducing method according to the  
present invention and a color image reproducing  
25 apparatus to which the method is applied will be  
described below with reference to embodiments shown in

the accompanying drawings.

Fig. 1 is a schematic block diagram showing the overall configuration of a color image reproducing apparatus according to the first embodiment using a  
5 single-sensor color camera which uses a complementary color imager as an image sensing device.

[0025]

Usually, a color image reproducing apparatus performs various processes necessary to reproduce color  
10 images. Therefore, an ordinary color image reproducing apparatus requires mechanisms for performing various processes not clearly illustrated in Fig. 1. Although these mechanisms are necessary in this embodiment, Fig. 1 shows minimum necessary mechanisms for explaining the  
15 processing and the configuration related to this embodiment.

[0026]

The color image reproducing apparatus of this embodiment shown in Fig. 1 comprises an image sensing  
20 unit 1, a white balance (WB) adjusting unit 2, a complementary color-pure color converting unit 3, a gamma correcting unit 4, and a complementary color-pure color conversion function determining unit 5. This complementary color-pure color conversion function  
25 determining unit 5 has a reference function storage 5a and a function converter 5b.



[0027]

The image sensing unit 1 has, e.g., a single-sensor color camera using a complementary color imager. The image sensing unit 1 senses the image of an object  
5 (not shown) and outputs two-dimensional digital data consisting of four different color components, magenta Ma, green Gr, yellow Ye, and cyan Cy, in accordance with complementary color filters of these colors, as the image sensing data of the object.

10 [0028]

By using the two-dimensional digital data output from the image sensing unit 1, the WB adjusting unit 2 extracts photographing light source information of the image sensing data (e.g., color temperature information  
15 or color component signals (Ma,Gr,Ye,Cy) corresponding to the photographing light source) and, on the basis of the photographing light source information, obtains so-called white balance coefficients. The white balance is adjusted by adjusting the gains of these color  
20 component signals (Ma,Gr,Ye,Cy) by using the white balance coefficients.

[0029]

Assuming that the white balance coefficients are represented by  $(k_{Ma}, K_{Gr}, K_{Ye}, K_{Cy})$ , complementary color data  
25  $(Ma', Gr', Ye', Cy')$  after the white balance adjustment are respectively represented by

$$Ma' = K_{Ma} \cdot Ma$$

$$Gr' = K_{Gr} \cdot Gr$$

$$Ye' = K_{Ye} \cdot Ye$$

$$Cy' = K_{Cy} \cdot Cy$$

5 [0030]

The complementary color-pure color converting unit 3 performs color space conversion for the complementary color data (Ma',Gr',Ye',Cy') whose white balance is adjusted by the WB adjusting unit 2, thereby obtaining  
 10 pure color data (R,G,B) as a reproduction image signal. As an example, this complementary color-pure color converting unit 3 converts the complementary color data (Ma',Gr',Ye',Cy') after the white balance adjustment into NTSC-RGB data.

15 [0031]

Generally, the conversion from the complementary color data (Ma',Gr',Ye',Cy') into the pure color data (R,G,B) is performed on the basis of functions  $f_R$ ,  $f_G$ , and  $f_B$  (to be collectively referred to as a function  $f$   
 20 hereinafter unless it is necessary to distinguish between them). That is,

$$R = f_R(Ma', Gr', Ye', Cy')$$

$$G = f_G(Ma', Gr', Ye', Cy')$$

$$B = f_B(Ma', Gr', Ye', Cy')$$

25 This function  $f$  is described by using a matrix or a lookup table (LUT), for example.

[0032]

In order to optimally display and record images, the gamma correcting unit 4 corrects the pure color data (R,G,B), which constitute the reproduction image  
5 signal obtained by the complementary color-pure color converting unit 3, by using the characteristics of an image displaying-recording apparatus (not shown), and outputs the corrected component signals (R',G',B') as a display recording signal.

10 [0033]

By using the photographing light source information or the white balance coefficients as more practical parameters obtained by the WB adjusting unit 2, the complementary color-pure color conversion  
15 function determining unit 5 obtains the complementary color-pure color conversion function  $f$  to be used in the complementary color-pure color converting unit 3. The complementary color-pure color conversion function  $f$  obtained by the complementary color-pure color  
20 conversion function determining unit 5 is supplied to the complementary color-pure color converting unit 3. On the basis of the supplied conversion function  $f$ , the complementary color-pure color converting unit 3 converts the complementary color data (Ma',Gr',Ye',Cy')  
25 into the pure color data (R,G,B).

[0034]

The color image reproducing apparatus with the above configuration primarily has its characteristic features in the processes and mechanisms of the WB adjusting unit 2, the complementary color-pure color converting unit 3, and the complementary color-pure color conversion function determining unit 5. That is, the color image reproducing apparatus of this embodiment comprises the complementary color-pure color conversion function determining unit 5 for obtaining the complementary color-pure color conversion function  $f$  used by the complementary color-pure color converting unit 3 to convert the complementary color data (Ma', Gr', Ye', Cy') into the pure color data (R, G, B). The color image reproducing apparatus of this embodiment is characterized in that this complementary color-pure color conversion function determining unit 5 receives the photographing light source information or the white balance coefficients obtained by the WB adjusting unit 2 and obtains the complementary color-pure color conversion function  $f$  on the basis of the received information.

[0035]

This characteristic feature will be described in detail below. Assume a complementary color-pure color conversion function (daylight complementary color-pure color conversion functions  $f_{R,D65}$ ,  $f_{G,D65}$ , and  $f_{B,D65}$ ; to be

collectively referred to as  $f_{D65}$  hereinafter) which is optimally set, e.g., on the basis of daylight (e.g., a D65 light source described by JIS) is previously stored as a reference complementary color-pure color

5 conversion function in the reference function storage 5a of the complementary color-pure color conversion function determining unit 5.

[0036]

The WB adjusting unit 2 extracts photographing  
10 light source information from image sensing data and obtains white balance coefficients for adjusting the gains of color component signals ( $M_a, G_r, Y_e, C_y$ ) on the basis of the light source information. The WB adjusting unit 2 performs white balance adjustment by  
15 balancing the color component signals ( $M_a, G_r, Y_e, C_y$ ) by using the white balance coefficients. Consequently, a change in the photographing light source is compensated for.

[0037]

20 The photographing light source information and the white balance coefficients obtained when this white balance adjustment is performed are supplied to the complementary color-pure color conversion function determining unit 5. On the basis of the photographing  
25 light source information and the white balance coefficients ( $k_{M_a}, K_{G_r}, K_{Y_e}, K_{C_y}$ ) supplied from the WB

adjusting unit 2, the function converter 5b in the complementary color-pure color conversion function determining unit 5 alters the above-mentioned reference complementary color-pure color conversion function fD65 and obtains the complementary color-pure color conversion function f corresponding to the white balance coefficients ( $k_{Ma}, K_{Gr}, K_{Ye}, K_{Cy}$ ). Note that the procedure of this alteration is previously described.

[0038]

10 For example, assume that the alteration procedure is given as follows:

$$f_R(Ma', GR', Ye', Cy') = f_{R,D65}(Ma', GR', Ye', Cy', k_{Ma}, K_{Gr}, K_{Ye}, K_{Cy})$$

$$f_G(Ma', GR', Ye', Cy') = f_{G,D65}(Ma', GR', Ye', Cy', k_{Ma}, K_{Gr}, K_{Ye}, K_{Cy})$$

$$f_B(Ma', GR', Ye', Cy') = f_{B,D65}(Ma', GR', Ye', Cy', k_{Ma}, K_{Gr}, K_{Ye}, K_{Cy})$$

15 When arbitrary white balance coefficients ( $k_{Ma}, K_{Gr}, K_{Ye}, K_{Cy}$ ) are supplied, the function f is uniquely determined in accordance with the white balance coefficients.

[0039]

20 The complementary color-pure color conversion function f obtained by the complementary color-pure color conversion function determining unit 5 in accordance with the photographing light source as described above is supplied to the complementary color-pure color converting unit 3. The complementary color-pure color conversion function f is used by the

25

complementary color-pure color converting unit 3 in the processing of converting the complementary color data (Ma',Gr',Ye',Cy') into pure color data (R,G,B).

[0040]

5        Fig. 2 is a schematic block diagram showing the overall configuration of a color image reproducing apparatus according to the second embodiment. Note that the same reference numerals as in the color image reproducing apparatus shown in Fig. 1 denote parts  
10        having the same functions in Fig. 2, and a detailed description thereof will be omitted.

[0041]

The color image reproducing apparatus of this second embodiment primarily has its characteristic  
15        features in the processes and mechanisms of a WB adjusting unit 2, a complementary color-pure color converting unit 3, a complementary color-pure color conversion function selecting unit 6, and a  
20        complementary color-pure color conversion function storage unit 7.

[0042]

That is, in the color image reproducing apparatus of this embodiment, complementary color-pure color conversion functions f used in the complementary color-  
25        pure color converting unit 3 to convert complementary color data (Ma',Gr',Ye',Cy') into pure color data

(R,G,B) are previously obtained for several photographing light sources. The apparatus comprises the complementary color-pure color conversion function storage unit 7 for storing and holding these

5 complementary color-pure color conversion functions f and the complementary color-pure color conversion function selecting unit 6 for selecting one of the plurality of complementary color-pure color conversion functions f stored in the complementary color-pure

10 color conversion function storage unit 7.

[0043]

The apparatus of this embodiment is characterized in that the complementary color-pure color conversion function selecting unit 6 receives photographing light

15 source information or white balance coefficients from the WB adjusting unit 2 and selects a proper complementary color-pure color conversion function f from the complementary color-pure color conversion function storage unit 7 on the basis of the information.

20 [0044]

That is, in this embodiment, a plurality of complementary color-pure color conversion functions f are prepared for several predicted photographing light sources and stored in the complementary color-pure

25 color conversion function storage unit 7. The complementary color-pure color conversion function



selecting unit 6 analyzes the photographing light source information or the white balance coefficients obtained by the WB adjusting unit 2, selects a complementary color-pure color conversion function f  
5 corresponding to the photographing light source from the complementary color-pure color conversion function storage unit 7, and supplies the selected complementary color-pure color conversion function f to the complementary color-pure color converting unit 3.

10 [0045]

In this second embodiment, it is unnecessary to alter the conversion function such as done in the complementary color-pure color conversion function determining unit 5 of the first embodiment. That is,  
15 it is only necessary to select an appropriate complimentary color-pure color conversion function f from the complementary color-pure color conversion function storage unit 7. Consequently, the processing can be performed at a higher speed than in the first  
20 embodiment.

[0046]

The third embodiment of the present invention will be described below. Fig. 3 is a block diagram showing an outline of the overall configuration of a color  
25 image reproducing apparatus according to the third embodiment. In the first and second embodiments

described above, photographing light source information is obtained from image sensing data from the image sensing unit 1. However, in this third embodiment, the photographing light source information is directly  
5 obtained from a light source used in photography.

[0047]

That is, as illustrated in Fig. 3, the color image reproducing apparatus of this embodiment comprises a photographing light source detecting unit 9 and a WB  
10 coefficient determining unit 10. In this configuration, the photographing light source detecting unit 9 detects or senses photographing light source information with respect to image sensing data output from an image sensing unit 1. The WB coefficient determining unit 10  
15 determines a white balance coefficient on the basis of the detected or sensed photographing light source information. The WB coefficient determining unit 10 supplies the white balance coefficient thus determined to a WB adjusting unit 2 and a complementary color-pure  
20 color conversion function determining-selecting unit 8.

[0048]

On the basis of the supplied white balance coefficient, the WB adjusting unit 2 adjusts the white balance. The complementary color-pure color conversion  
25 function determining-selecting unit 8 calculates or selects a complementary color-pure color conversion

function  $f$  corresponding to the photographing light source. This processing of calculating the complementary color-pure color conversion function  $f$  is performed in the same manner as in the first embodiment.

- 5 The processing of selecting the complementary color-pure color conversion function  $f$  is performed in the same way as in the second embodiment.

[0049]

The complementary color-pure color conversion  
10 function  $f$  thus calculated or selected by the complementary color-pure color conversion function determining/selecting unit 8 is supplied to a complementary color-pure color converting unit 3 where the function is used in complementary color-pure color  
15 conversion.

[0050]

In addition to the configuration shown in Fig. 3 in which both the photographing light source detecting unit 9 and the image sensing unit 1 are juxtaposed in  
20 the apparatus and the photographing light source is constantly detected, there can be a configuration where the image sensing unit 1 is separately arranged and supplies image sensing data to the apparatus by some means. For example, if information of the  
25 photographing light source is added to the image sensing data, photographing light source information

may be detected from the additional data.

[0051]

The rest of the configuration and operation of the image reproducing apparatus according to the third embodiment shown in Fig. 13 is almost the same as the configurations and operations of the first and second embodiments described above, and so a detailed description thereof will be omitted. Refer to the above description to understand this embodiment.

10 [0052]

In the first to third embodiments as described above, a complementary color-pure color conversion function as one of a plurality of image reproduction parameters constituting an image reproduction parameter group is calculated on the basis of a white balance coefficient as another image reproduction parameter. Therefore, the white balance and the complementary color-pure color conversion function associated with the white balance can be efficiently and accurately set without producing any contradiction between them. Consequently, images can be properly reproduced in accordance with the photographing light source.

[0053]

As described above, the principal object of this embodiment is to calculate a certain image reproduction parameter from another relevant image reproduction

parameter, thereby accurately reproducing images.  
Examples of image reproduction parameters constituting  
an image reproduction parameter group are parameters  
describing a color temperature, a white balance  
5 coefficient, a color component gain, white point  
information, black point information, a gamma  
coefficient, a gradation characteristic, a gradation  
conversion curve, a gradation conversion lookup table,  
a knee point, a dynamic range, a color gamut, light  
10 source information, a color coordinate conversion  
matrix coefficient, a spatial frequency characteristic,  
a black (gray) balance coefficient, an S/N ratio, an  
auto-correlation coefficient, a Wiener spectrum, an  
intensity (density) distribution, and a luminance  
15 distribution, and parameters obtained directly or  
indirectly from these information.

[0054]

Note that the present invention is not limited to  
the disclosure set forth with reference to the first to  
20 third embodiments as described above and various  
sequence processing operations can be applied without  
departing from the scope and spirit of the present  
invention. For example, the present invention may be  
theorized or implemented in software. Alternatively,  
25 the present invention may be applied to a hardware or  
apparatus which operates in accordance with an

algorithm or the like created without departing the scope and spirit of the present invention as described above.

[0055]

5                   [Effect of the Invention]

As described above, according to the present invention, at least one of a plurality of different image reproduction parameters used in the conversion from an image sensing signal to an image signal is  
10 obtained from at least another image reproduction parameter. Accordingly, it is possible to avoid the inconveniences, when these image reproduction parameters are individually determined, that a contradiction occurs between correlated image  
15 reproduction parameters and parameters are determined inefficiently in a conventional case. Consequently, image sensing signals can be converted into image signals by using an image reproduction parameter group consisting of more accurate image reproduction  
20 parameters corresponding to the condition of the photographing light source. This makes accurate and desired image reproduction feasible.

[Brief Description of the Drawings]

[Fig. 1]

25 Fig. 1 is a block diagram showing an outline of the configuration of a color image reproducing apparatus

according to the first embodiment of the present invention.

[Fig. 2]

Fig. 2 is a block diagram showing the schematic  
5 configuration of a color image reproducing apparatus  
according to the second embodiment of the present  
invention.

[Fig. 3]

Fig. 3 is a block diagram showing the schematic  
10 configuration of a color image reproducing apparatus  
according to the third embodiment of the present  
invention.

[Fig. 4]

Fig. 4 is a schematic block diagram showing an example  
15 of a conventional image reproducing apparatus.

[Fig. 5]

Fig. 5 is a schematic block diagram showing another  
example of a conventional image reproducing apparatus.

[Description of the Reference Numerals]

- |    |   |  |
|----|---|--|
| 20 | 1 | image sensing unit                             |
|    | 2 | WB adjusting unit (for complementary<br>color) |
|    | 3 | complementary color-pure color<br>converting   |
| 25 |   | unit   |
|    | 4 | gamma correcting unit                          |

5	complementary color-pure color
conversion	
	function determining unit
5a	reference function storage
5 5b	function converter
6	complementary color-pure color
conversion	
	function selecting unit
7	complementary color-pure color
10 conversion	
	function storing-holding unit
8	complementary color-pure color
conversion	
	function determining-selecting unit
15 9	photographing light source detecting
unit	
10	WB coefficient determining unit



[Type of the Document] Abstract

[Abstract]

[Problem] It is an object of the present invention to constantly perform appropriate complementary color-pure  
5 color conversion, thereby enabling faithful reproduction of images even if a photographing light source changes.

[Solving Means] A complementary color-pure color conversion function determining unit 5 is provided to  
10 calculate a complementary color-pure color conversion function used in complementary color-pure color conversion processing performed in a complementary color-pure color converting unit 3 on the basis of a white balance coefficient which is used in white  
15 balance adjustment processing performed in a WB adjusting unit 2. The complementary color-pure color conversion function as one of a plurality of image reproduction parameters used upon image reproduction is obtained on the basis of the white balance coefficient  
20 determined in accordance with the photographing light source. As a result, inconveniences that a contradiction occurs between the correlated image reproduction parameters and the parameters are inefficiently determined can be eliminated. Therefore,  
25 an image sensing signal can be converted into an image signal by using a more accurate image reproduction

7-205886

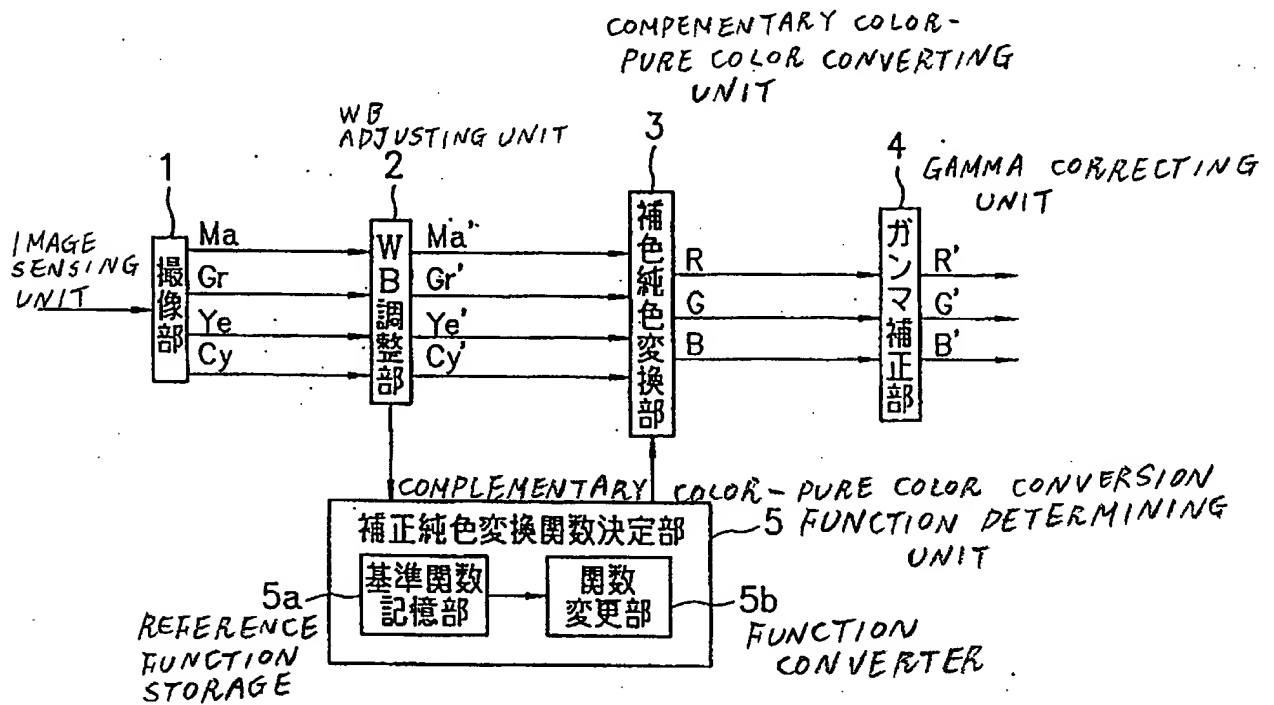
parameter determined in accordance with the  
photographing light source.

[Selected Drawing] Fig. 1

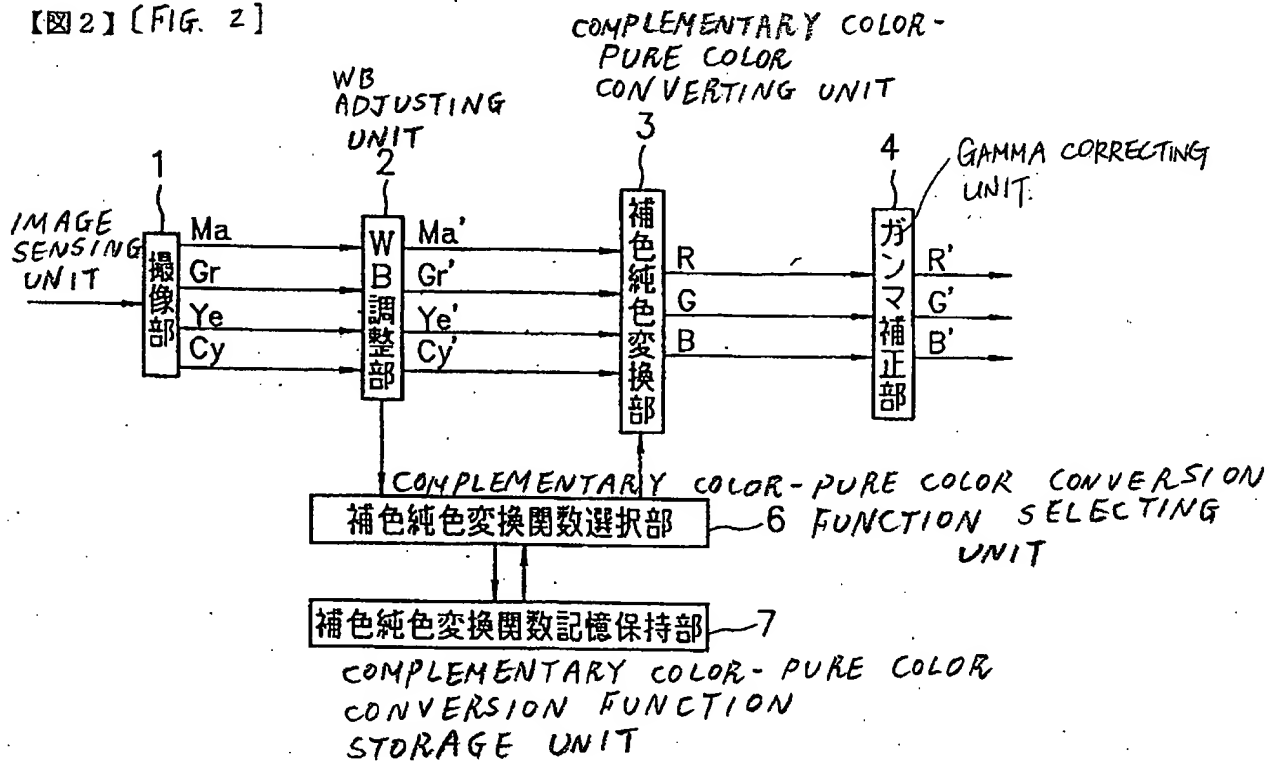
[TYPE OF THE DOCUMENT] DRAWINGS

【書類名】 図面

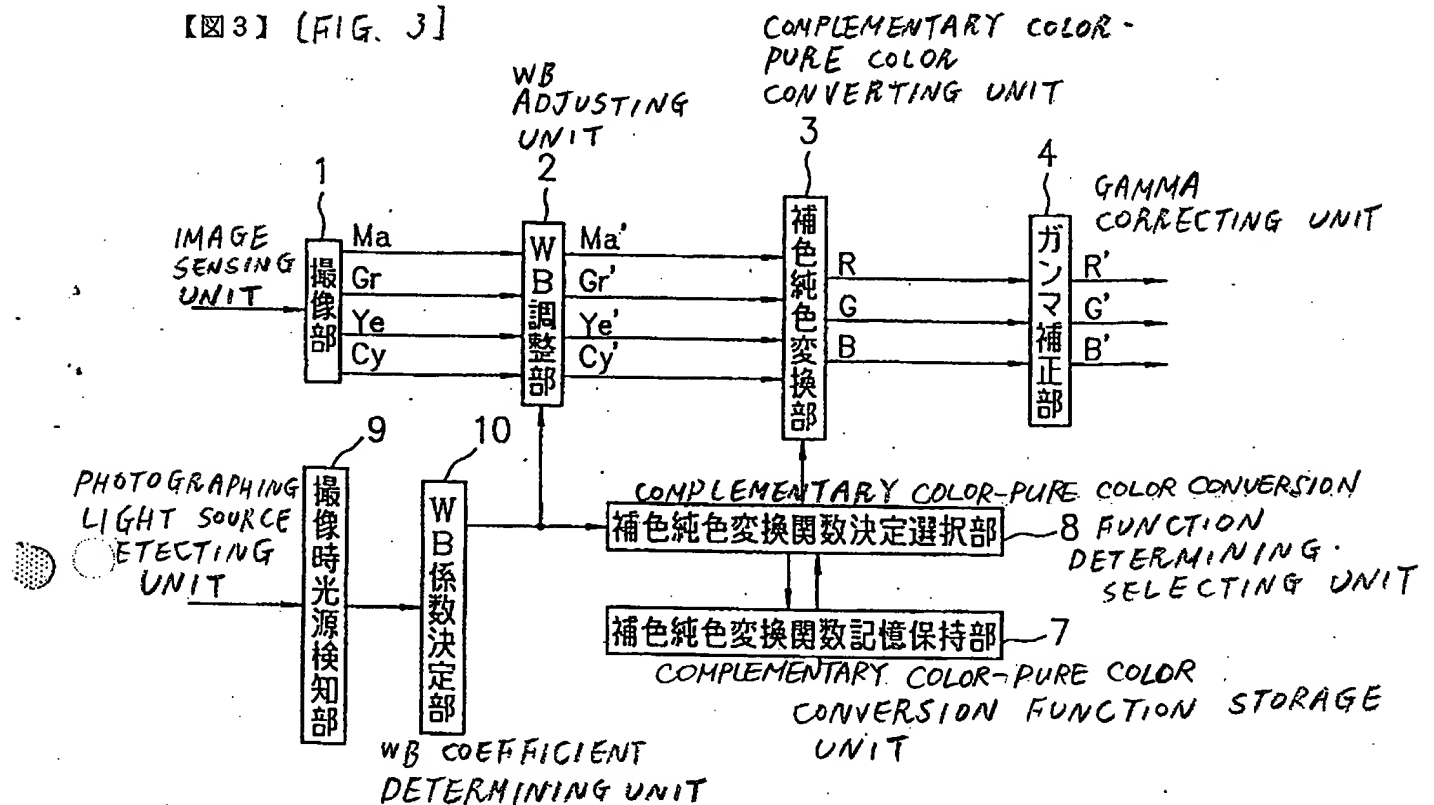
【図1】 [FIG. 1]



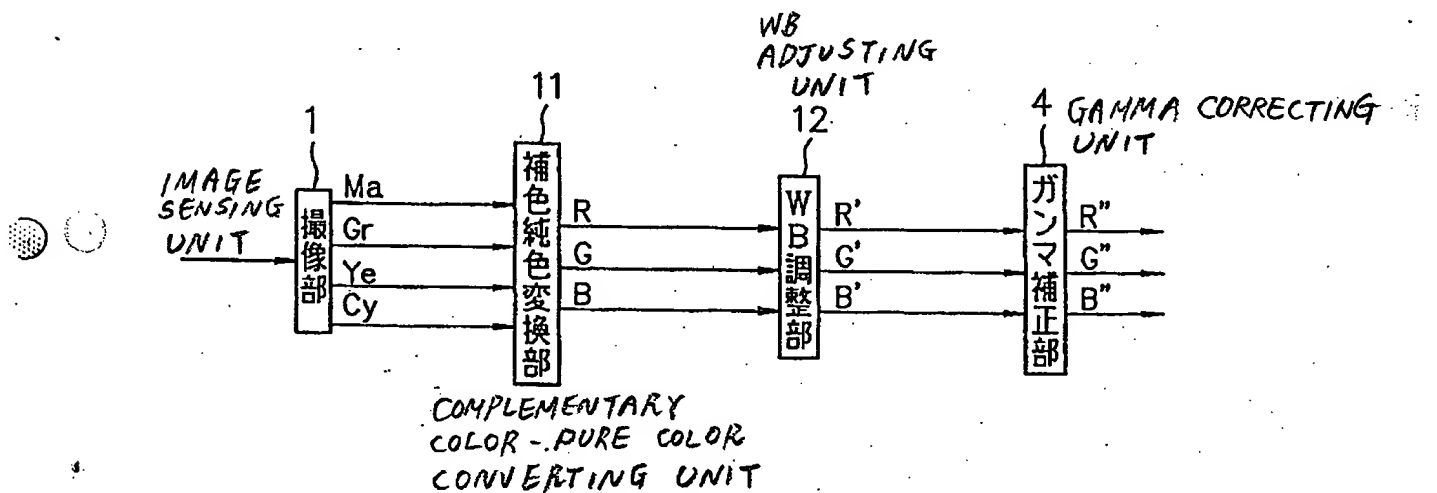
【図2】 [FIG. 2]



【図3】 [FIG. 3]



【図4】 [FIG. 4]



【図5】 [FIG. 5]

